UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF SOUTH CAROLINA

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| FRIENDS OF THE EARTH, INC., *et al.*,<br><br>Plaintiffs,<br><br>v.<br><br>GASTON COPPER RECYCLING CORPORATION,<br><br>Defendant. | Civil No. 3:92-2574-O |

**DECLARATION OF BRUCE A. BELL, Ph.D., P.E., BCEE**

1. I am currently president of Carpenter Environmental Associates, Inc., of Monroe, New York, an environmental science and engineering firm. I hold a Bachelor's degree in civil engineering, a Master's degree in environmental engineering, and a Ph.D. in environmental engineering, all from New York University. I am a registered professional engineer in New York, New Jersey, and Pennsylvania. I am Board Certified by the American Academy of Environmental Engineers. I have over 38 years experience in environmental engineering.

2. My experience includes the design and evaluation of wastewater treatment plants and evaluation and modeling of water quality impacts of discharges to receiving waters. I have taught water quality modeling and assessment of water quality impacts at the graduate level at The George Washington University and New Jersey Institute of Technology as well as teaching numerous other courses in environmental engineering at the undergraduate and graduate levels. I have also directed doctoral student research in the area of water quality modeling. My qualifications, along with a list of my publications, are contained in my curriculum vitae, which is attached as Attachment A.

3. I have been recognized as an expert in environmental engineering, including wastewater treatment and water quality modeling, by this Court and other federal courts and have provided testimony at deposition and at trial in this case and in other cases.

4. I have been asked to address the question of whether the pollutants discharged by Gaston Copper Recycling Corporation ("Gaston") travel downstream in the Edisto River from its confluence with Bull Swamp Creek and if so, how far they travel.

5. As explained in detail below, metals discharged by Gaston in soluble or dissolved form have traveled at least 105 miles in the Edisto River downstream of its

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confluence with Bull Swamp Creek and likely somewhat beyond that point. Moreover, metals in particulate form discharged by Gaston have likely settled in sediments in Boggy Branch, Bull Swamp Creek, and the Edisto River. The settled metals likely were periodically scoured and resuspended by high river flows and moved downstream before resettling.

6. The Court of Appeals for the Fourth Circuit has decided, based primarily on an official written response from the South Carolina Department of Health and Environmental Control ("DHEC"), that Gaston's discharges can impact Boggy Branch and Bull Swamp Creek to the confluence of Bull Swamp Creek and the Edisto River.[1] I agree with this conclusion. I, therefore, address pollutant transport in the Edisto River downstream of its confluence with Bull Swamp Creek.

7. This Court found Gaston violated its National Pollutant Discharge Elimination System ("NPDES") permit limitations for cadmium, copper, iron, zinc, pH, and oil and grease ("O&G").[2] In addition, this Court found that Gaston violated monitoring and reporting requirements for additional pollutants, including lead, mercury, and nickel. By failing to properly monitor and report for lead, mercury, and nickel, Gaston made it impossible to determine if effluent limitations were violated for those pollutants.

8. I have focused my analysis of the transport of pollutants for which Gaston violated its effluent limits and/or monitoring and reporting limits to metals and, more specifically to dissolved metals, including cadmium, copper, iron, lead, mercury, nickel, and zinc. I have done so because necessary data are available to assess the transport of these dissolved metals downstream from the confluence of Bull Swamp Creek and the Edisto River. Data are not available to properly model the transport of other pollutants downstream of the confluence and collection of such data would require significant time and expense.

9. Metals discharged into the environment are persistent. The specific form or species of the metals may change but the metals will remain. Metals discharged into water may be in dissolved or particulate form. Dissolved metals, also referred to as soluble metals, will behave in a similar way to sugar dissolved in water. The sugar will not be visible but it will be present, impart sweetness to the water, and will move along with the water. Similarly, dissolved metals will also not be visible, but toxicity associated with the metals will be present and the metals will move with the water. Metals can change between dissolved and particulate forms depending on the water chemistry. The major chemical parameters controlling whether metals will be dissolved or particulate are alkalinity and pH. Alkalinity is

[1] Opinion of U.S. Court of Appeals for the Fourth Circuit, No. 06-1714, Friends of the Earth, Inc. and CLEAN Inc., v. Gaston Copper Recycling Corporation, February 2, 2008.

[2] United States District Court for the Southern District of South Carolina, June 18, 2003.

the acid neutralizing capacity of water. pH is a measure of how acidic or alkaline water is.[3]

10. Dissolved metals will move downstream with the water flow in the Edisto River. Particulate metals will settle and move from the water flow to the sediment during low or average flows. The rate and location of particulate metals settling depends on the size of the particles and the flow rate and turbulence in the water. The data necessary to model the settling particulate metals are not available; however, particulate metals in rivers typically settle at low flows and are resuspended and moved downstream during high flow events. Thus, particulate metals are typically moved downstream in a series of steps consisting of settling, resuspension, and resettling.

11. While data are not available to model the downstream movement of particulate metals, flow data from the Edisto allow a qualitative assessment of whether settling, resuspension, and subsequent resettling of particulate metals will occur. Examination of the United States Geological Survey ("USGS") gage data for the North Fork of the Edisto River at Orangeburg, South Carolina ("SC"), which is approximately 15 miles downstream of the confluence of Bull Swamp Creek and the Edisto River, show a large variation in daily average flows between 1990 and May 2008.[4] During that period, average daily flows averaged 660 cubic feet per second (cfs) and ranged from a low of 113 cfs to a high of 4,960 cfs, a variation of over 40 to 1.

12. Even more extreme flow variations can be seen from USGS gage data for the Edisto River near Givhans, SC, which is approximately 104 miles downstream of the confluence of Bull Swamp Creek and the Edisto River.[5] The data show a large variation in daily average flows. During the period between 1990 and May 2008, daily flows averaged 2,302 cfs and ranged from a low of 150 cfs to a high of 22,300 cfs, a variation of over 148 to 1.

13. Such high variations in flow will, in my experience, result in the scouring of solids which have settled during low flows off the river bottom and resuspension of the metals at high flows. Those solids will resettle further downstream when flows return to normal.

[3] Sawyer, C.N. and P.L. McCarty, *Chemistry for Environmental Engineering*, McGraw Hill Publishing Company, 1978.

[4] USGS Gage 02173500.

[5] USGS Gage 02175000.

14. The Edisto River is a "black water" river. Black water rivers are relatively clear systems that are highly colored (coffee or tea-colored).[6,7] The coloring is due to the presence of dissolved organics derived from natural sources such as swamp drainage and the decomposition of organic materials such as leaves. The organic acid (tannic acid) that is released from the decomposition causes the coloration of the water.[8 9]

15. Under my direction, Greg M. Fleischer of my staff performed a site visit and visual inspection to determine whether Boggy Branch and Bull Swamp Creek had characteristics of black water rivers similar to the Edisto River. The inspection was carried out by canoeing some portions of the Edisto near its confluence with Bull Swamp Creek and by driving to locations where the Edisto River could be inspected and photographed. All three water bodies have sandy bottoms and limited organic vegetation accumulations at the banks. Based on inspection of the photographs and the information provided to me by Mr. Fleischer, it is my opinion that all three water bodies, the Edisto River, Bull Swamp Creek, and Boggy Branch, have the characteristics of black water rivers, including tea or coffee-colored clear water.

16. The chemical mechanism by which soluble or dissolved metals are converted to and from insoluble or particulate metals depends primarily on the concentration of hydroxyl ions, which is measured by pH, and the concentration of carbonate ions, which is measured by alkalinity. At high pH and high alkalinity concentrations, metals precipitate and become insoluble. At low pH and low alkalinity concentrations, metals become soluble or dissolve.[10] Toxicity of metals is also related to receiving water hardness, with metals being more toxic in soft water than in hard water.[11]

17. Water chemistry data are available from United States Environmental Protection Agency ("USEPA") STORET database for a number of locations in Bull Swamp Creek and in the Edisto River downstream of its confluence with Bull Swamp Creek.[12] STORET stations are shown in Attachments B and C. I examined these data to determine if the water chemistry in the Edisto River downstream of the

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[6] Assessing Change in the Edisto River Basin: An Ecological Characterization, South Carolina Water Resources Commission Report No. 177, October 1993, pp. 70.

[7] Watershed Water Quality Assessment, Edisto River Basin, South Carolina Department of Health and Environmental Control, October 2004, pp. 8.

[8] Assessing Change in the Edisto River Basin: An Ecological Characterization, South Carolina Water Resources Commission Report No. 177, October 1993, pp. 70.

[9] Watershed Water Quality Assessment, Edisto River Basin, South Carolina Department of Health and Environmental Control, October 2004, pp. 8.

[10] U.S. Army Corps of Engineers, Engineering and Design, Precipitation /Coagulation/ Flocculation, Manual 1110-1-4012, November 15, 2001.

[11] South Carolina Department of Health and Environmental Control, Water Classifications and Standards, Regulation 61 – 68, June 25, 2004.

[12] The USEPA STORET database is a compilation of nationwide water quality data maintained by the USEPA and is publicly available. Data in the STORET database were examined from 1992 to 2006.

confluence was 1) different from that in Boggy Branch and/or Bull Swamp Creek in a manner that would affect solubility of metals; and 2) if the water chemistry of the Edisto River was conducive to the metals remaining dissolved.

18. Data on water chemistry in Bull Swamp Creek are available from two USEPA STORET database stations: Station E-034, located in Bull Swamp Creek approximately one mile downstream of Gaston's discharge, and Station E-042, located in Bull Swamp Creek approximately one mile upstream of its confluence with the Edisto River. The water in Bull Swamp Creek is very soft and has little alkalinity. Soft water is generally considered to have hardness less than 75 parts per million (ppm) as calcium carbonate ($CaCO_3$).[13] At Station E-034 the hardness averages 6 ppm $CaCO_3$; the alkalinity also averages only 6 ppm as $CaCO_3$; and the median pH is 5.9 units.[14] [15] At Station E-042 the hardness averages 5 ppm as $CaCO_3$; the alkalinity averages only 4 ppm as $CaCO_3$; and the median pH is 5.8 units.[16]

19. Data on water chemistry in the Edisto River are also available from USEPA STORET database stations. STORET Station E-008A is located on the North Fork of the Edisto River approximately 40 miles downstream of the confluence with Bull Swamp Creek Water chemistry in the Edisto River at Station E-008A continues to show very soft water with low alkalinity and low median pH. At Station E-008A the hardness averages 10 ppm as $CaCO_3$; the alkalinity averages only 7 ppm as $CaCO_3$; and the median pH is 6.3 units.[17]

20. Similar Edisto River water quality is shown at USEPA STORET Station E-086, which is located approximately 90 miles downstream of the confluence with Bull Swamp Creek. Water chemistry in the Edisto River at Station E-086 continues to show very soft water with low alkalinity and low median pH. At Station E-086 the hardness averages 10 ppm as $CaCO_3$; the alkalinity averages only 10 ppm as $CaCO_3$; and the median pH is 6.5 units.[18]

21. Similar Edisto River water quality is shown at USEPA STORET Station E-015, which is located approximately 105 miles downstream of its confluence with Bull Swamp Creek. Water chemistry in the Edisto River at Station E-015 continues to

[13] Sawyer, C.N. and P.L. McCarty, *Chemistry for Environmental Engineering*, McGraw Hill Publishing Company, 1978.

[14] USEPA STORET sampling data for station E-034, located at Bull Swamp Creek, 1.1 miles northwest of Swansea, July 12, 1973-December 6, 2006.

[15] A pH value of 7.0 is considered neutral, with pH values below 7.0 being acidic and pH values greater than 7.0 being alkaline. Because pH values are on a logarithmic scale, a pH of 5.9 is over 10 times more acidic than neutral.

[16] USEPA STORET sampling data for station E-042, located at Bull Swamp Creek at the bridge over Road 189, 1996 – 2006.

[17] USEPA STORET sampling data for Station E-008A, located on the North Edisto River at State Road 38-63, 1996 – 2006.

[18] USEPA STORET sampling data for Station E-086, located on the Edisto River, 9.5 miles southeast of St. George, 1996 – 2006.

show very soft water with low alkalinity and low median pH. At Station E-015 the hardness averages 17 ppm as $CaCO_3$; the alkalinity averages only 14 ppm as $CaCO_3$; and the median pH is 6.7 units. Very low levels of salinity are occasionally present at Station E-105, indicating the upstream extent of mixing with ocean waters.[19]

22. USEPA STORET Station MD-119, which is located approximately 133 miles downstream of the confluence of Bull Swamp Creek and the Edisto River, shows mixing with saline water.[20] The chemical composition of the water clearly has changed.

23. Based upon my analysis of water chemistry in the Edisto River, it is my opinion that a substantial portion of the metals discharged by Gaston reached a location at least 105 miles downstream of the confluence of Bull Swamp Creek and the Edisto River.

24. As explained above, the way in which the metals in Gaston's discharge travel in downstream waters is a function of whether the metals are soluble/dissolved or insoluble/particulate. Total recoverable metals tests approved by USEPA for discharge monitoring of metals do not differentiate between soluble and particulate forms of a particular metal. The test only reports the total concentration of that metal regardless of form.[21] In many contexts, particularly in toxicity testing associated with establishing water quality criteria and in determining the appropriate water quality criteria or standards for a particular water body, it is important to know the fraction of the total concentration of a metal that is soluble versus insoluble. To that end, USEPA established the total recoverable metals approach in conjunction with establishing water quality standards for priority toxic pollutants, which includes metals, for the State of California known as the California Toxics Rule.[22] Because the chemistry of waters used in these tests result in the metals being present in both dissolved and particulate form, USEPA developed conversion factors that allow calculation of the percentage of total metals that will be in dissolved form in the waters used in testing. South Carolina uses the metals criteria from the California Toxics Rule.[23]

25. In order to establish a convenient means for determining what percentage or fraction of the total metals are soluble/dissolved, USEPA used synthetic waters that it created in order to control the hardness, alkalinity, and pH, since it is these three factors that predominantly control whether metals are in a soluble or

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[19] USEPA STORET sampling data for Station E-015, located on the Edisto River at State Road 61, 1996 – 2006.

[20] USEPA STORET sampling data for Station MD-119, located on the Edisto River at U.S. 17.

[21] 40 CFR 136.

[22] 40 CFR Part 131: Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, Rule, Federal Register Part III, May 18, 2000.

[23] South Carolina Department of Health and Environmental Control, Water Classifications and Standards, Regulation 61 – 68, June 25, 2004.

insoluble state. Some of the synthetic water created by USEPA was very soft with a low hardness, low alkalinity, and low pH; other synthetic water was very hard with high hardness, high alkalinity, and high pH.[24] Based on averages from the various synthetic waters it created, USEPA established a conversion factor for each metal that is used to determine the percentage of the total metal that is soluble/dissolved.

26. Water in the Edisto River has the same or lower hardness, less alkalinity, and lower pH than even the very soft synthetic water used by USEPA in developing its conversion factors Because the hardness, alkalinity, and pH in the Edisto River are lower than that in even the softest synthetic water USEPA used to derive the conversion factors used for determining what percentage of the total metals are soluble/dissolved, the USEPA conversion factors for the metals discharge by Gaston will understate the actual percentage of metals that will be dissolved downstream of the confluence of Bull Swamp Creek with the Edisto River.

27. Based on the conversion factors determined by USEPA, at least 97% of the cadmium, 96% of the copper, 99% of the lead, 85% of the mercury, 99% of the nickel, and 98% of the zinc impacting the water at the confluence of Bull Swamp Creek and the Edisto River will remain soluble for at least 105 miles downstream of the confluence.[25] [26] USEPA conversion factors for iron are not available. Ferrous iron, however, is close to 100% soluble in waters with low alkalinity and low pH such as the waters in the Edisto River at least 105 miles downstream of the confluence with Bull Swamp Creek. Soluble metals move downstream with the water in the Edisto River. Thus, a substantial portion of the dissolved metals discharged by Gaston will move at least 105 miles downstream in the Edisto River.

28. Samples in Bull Swamp Creek at USEPA STORET Stations E-034 and E-042 contained concentrations of cadmium, copper, iron, lead, nickel, and zinc at levels above South Carolina water quality standards, as shown in the following chart:

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[24] USEPA, *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*, October 2002.

[25] South Carolina Department of Health and Environmental Control, Water Classifications and Standards, Regulation 61 – 68, June 25, 2004.

[26] The conversion factors for cadmium and lead are dependant on water hardness. South Carolina Department of Health and Environmental Control regulations recommend using not less than 25 ppm hardness as $CaCO_3$. I used the recommended hardness which will result in understating the percentage of cadmium and lead which will dissolve.

**Occurrences of Violations of Water Quality Standards in Bull Swamp Creek at USEPA STORET Stations E-034 and E-042[27] [28] [29]**

| Metal | Detected above water quality standard for acute toxicity? | Detected above water quality standard for chronic toxicity? |
|---|---|---|
| Cadmium | Yes | Yes |
| Copper | Yes | Yes |
| Iron | No | Yes |
| Lead | Yes | Yes |
| Nickel | No | Yes |
| Zinc | Yes | Yes |

* At Station E-42 only

29. Samples in the Edisto River up to 105 miles downstream of its confluence with Bull Swamp Creek at USEPA STORET Stations E-008A, E-086, and E-015 contained concentrations of cadmium, copper, iron, lead, nickel, and zinc at levels above South Carolina water quality standards, as shown in the following chart:

**Occurrences of Violations of Water Quality Standards in the Edisto River at USEPA STORET Stations E-008A, E-086, and E-015[30] [31] [32] [33]**

| Metal | Detected above water quality standard for acute toxicity? | Detected above water quality standard for chronic toxicity? |
|---|---|---|
| Cadmium | Yes | Yes |
| Copper | Yes | Yes |
| Iron | No | Yes |
| Lead | Yes | Yes |
| Nickel | No | Yes |
| Zinc | Yes | Yes |

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[27] South Carolina Department of Health and Environmental Control, Water Classifications and Standards, Regulation 61 – 68, June 25, 2004.
[28] USEPA STORET sampling data for station E-034, located at Bull Swamp Creek, 1.1 miles northwest of Swansea, 1996 – 2006.
[29] USEPA STORET sampling data for station E-042, located at Bull Swamp Creek at the bridge over Road 189, 1996 – 2006.
[30] South Carolina Department of Health and Environmental Control, Water Classifications and Standards, Regulation 61 – 68, June 25, 2004.
[31] USEPA STORET sampling data for Station E-008A, located on the North Edisto River at State Road 38-63, 1996 – 2006.
[32] USEPA STORET sampling data for Station E-086, located on the Edisto River, 9.5 miles southeast of St. George, 1996 – 2006
[33] USEPA STORET sampling data for Station E-015, located on the Edisto River at State Road 61, 1996 – 2006

30. Presence of the same metals that were discharged by Gaston in Bull Swamp Creek and for at least 105 miles in the Edisto River downstream of its confluence with Bull Swamp Creek confirms that the water chemistry is conducive to metals discharged by Gaston remaining dissolved and moving downstream with the water.

31. I have reviewed the affidavit of Guy Jones, a member of CLEAN and Friends of the Earth. In his affidavit, Mr. Jones discusses four routes he has canoed on the Edisto River. Those routes are from Slab Landing Road to Shillings Bridge Road, from Shillings Bridge Road to the Edisto Gardens in Orangeburg, from Rowesville to Branchville, and from Green Pond Church to Colleton State Park. All of these routes are within the 105 miles downstream of the confluence of Bull Swamp Creek and the Edisto River that are impacted by the discharge from Gaston's facility (except that Slab Landing Road is slightly upstream of the confluence). The locations of these routes may be seen in the attached figure labeled "Guy Jones' Trips on the Edisto River" (Attachment B).

32. I have reviewed the affidavit of William Anderson, a member of Friends of the Earth. In his affidavit, Dr. Anderson states that he has visited locations on the Edisto River at or near Orangeburg, the McAlhany Nature Preserve (near St. George), Canadys, and Givhans Ferry State Park. All of these locations are within the 105 miles downstream of the confluence of Bull Swamp Creek and the Edisto River that are impacted by the discharge from Gaston's facility. The approximate locations are shown in the attached figure labeled "William Anderson's Trips on the Edisto River" (Attachment C).

Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed on May 30, 2008.

Bruce Bell

BRUCE BELL

**CARPENTER ENVIRONMENTAL ASSOCIATES, INC.**
**CEA ENGINEERS, P.C.**

# CURRICULUM VITAE

## BRUCE A. BELL, Ph.D., P.E., BCEE, PRESIDENT

## EDUCATION
B.S. Civil Engineering, New York University, 1968
M.S. Civil Engineering, New York University, 1969
Ph.D. Environmental Engineering, New York University, 1974

## REGISTRATION
Registered professional engineer in New York , New Jersey, and Pennsylvania
Board Certified Environmental Engineer by the American Academy of Environmental Engineers

## PROFESSIONAL HISTORY
**President, Carpenter Environmental Associates, Inc., Monroe, New York, 1978 - present**
Promoted to President in 1991.

Responsible for technical direction of all engineering activities of the firm including:

### Wastewater/Stormwater
- Design and supervision of construction for the upgrading of municipal sewage treatment plants.
- Design of several small private wastewater treatment plants.
- Collection system evaluations: CSO/SSO.
- Operational evaluation, process testing and review, and troubleshooting of POTWs.
- Facility Planning review and analysis.
- Conceptual design for biological nutrient removal.
- Peer review of biological nutrient removal and BAF applied research
- Waste treatability studies for industrial wastes.
- Sludge treatment and management evaluations.
- Water quality modeling; Waste assimilative capacity studies.
- Stormwater runoff modeling.
- NPDES permitting, comments, negotiations, and appeals.
- Industrial pretreatment studies and implementation of industrial pretreatment programs.
- Preparation of stormwater management plans and Stormwater Pollution Prevention Plans (SWPPPs).

### Site Assessments/Hazardous Materials
- SPCC/DPCC Plans.
- Hazardous waste site assessment and remediation.
- Preparation and evaluation of environmental impact statements.
- RCRA closures.

### Litigation Support
- Technical litigation support and expert witness testimony at deposition and trial in federal and state courts in the areas of: Clean Water Act, RCRA, CAFOs, Storm Water, and Insurance.

**Associate Professor and Professor of Engineering, The George Washington University, Washington, D.C., 1978 - 1987**
Promoted to Professor of Engineering in 1982.

Responsible for the University's environmental engineering program.

Directed both graduate and sponsored research.

Taught undergraduate and graduate courses in water supply, wastewater treatment, industrial waste treatment, sanitary engineering design, hydraulics, environmental chemistry, principles of environmental engineering, and environmental impact assessment.

Served as visiting research scientist and consultant at the U.S. Army Medical Bioengineering Research and Development Laboratory.

**Project Manager and Vice President, Flood & Associates, Inc., Consulting Engineers of Jacksonville, Florida, 1975 - 1978**
Promoted to vice president and director of environmental engineering design in 1976.

Responsible for the technical and financial aspects of all of the firm's environmental engineering design projects.

Served as project manager for numerous major treatment plant, collection system, and pumping station design projects including: design of a 20 MGD advanced wastewater treatment plant which included phosphorous removal, nitrification, denitrification, filtration and ozonation, as well as sludge incineration and lime recovery through recalcination; design of the upgrading and expansion of a 10 MGD lime water softening plant; design of sludge and solids handling systems for a 35 MGD municipal wastewater treatment plant; design of a 5 MGD pure oxygen expansion for a combined municipal/brewery waste treatment plant; design of a 15 MGD activated sludge plant; and design of several large wastewater pumping stations and associated gravity sewers.

Responsible for review of technical content of the firm's 201 Facilities Plans and sludge management studies.

Directed the firm's efforts as consultant to the Commonwealth of Virginia in the research, development, planning, and design related to the contamination of the James River and Hopewell wastewater treatment plant with the pesticide Kepone. Responsible for the preparation of alternative analysis for the remediation of Kepone contamination of the Hopewell wastewater treatment plant. Directed research efforts in Kepone biodegradation and incineration.

**Systems Manager, Envirotech Corporation, Belmont, California, 1973 - 1975**
Responsible for profit and loss for chemical-physical and advanced wastewater treatment systems, including thermal and solids handling systems and carbon regeneration systems.

Provided marketing and technical sales support, as well as application engineering.

Responsible for allocation and management of research and development funds in the area of advanced wastewater treatment.

Directed pilot studies in the areas of advanced wastewater treatment, carbon regeneration, and thermal sludge disposal. Carried out research into carbon adsorption and regeneration.

Responsible for process and system designs for solids handling systems and advanced wastewater treatment systems.

**Instructor of Civil Engineering, New York University, New York, 1969 - 1973**

Taught sixteen different courses in Civil and Sanitary Engineering.

Maintained active consulting practice in environmental engineering.

Consulting activities included wastewater treatability studies, pilot plant investigations, design of industrial pretreatment facilities, lake evaluations, and environmental impact analysis.

## AFFILIATIONS

Water Environment Federation
International Water Association
American Society of Civil Engineers
American Academy of Environmental Engineers

## HONORS

Board Certified by theAmerican Academy of Environmental Engineers
Member of Tau Beta Pi, Chi Epsilon, and Perstare et Preaestare honor societies
Received the Founders Day Award and Hydraulics Prize from New York University
Received the Outstanding Design Achievement Award from the Florida WPCA
Nominated for the WPCF Eddy Medal for paper on Munitions Waste Treatment
Listed in **Who's Who in the South and Southwest, International Who's Who in Engineering,** and **American Men and Women of Science**

## PROFESSIONAL ACTIVITIES

Served as a reviewer for WPCF (WEF) Manuals of Practice for Sludge Thickening, Nutrient Removal, and Sludge Conditioning.
Member of ASCE publication review committee (1979 - ).
Member WPCF Technical Practices Committee (1977 - 1988).
Reviewer, Research and Equipment proposals, NSF (1979 - 1988).
Member Program Committee and Conference Co-chair, Seminar on Development and Assessment of Environmental Quality Standards, American Academy of Environmental Engineers (1981).
Faculty, short course on Hazardous Waste Management, Harvard School of Public Health (1982).
Faculty, short courses on Hazardous Waste Management in the 80's, American Public Health Association (1983).
Conference Co-Chairman, Conference on the Treatment of Metal Bearing Wastewaters, NRDC/Texas Instruments, Inc., Mansfield, MA. (1985).
State Membership Chairman, American Academy of Environmental Engineers (1985 - 1987).
Faculty member and developer of course materials, Industrial Pretreatment Enforcement - A Workshop for POTW Attorneys, USEPA and Environmental Law Institute (1990 - 1992).
Faculty member New England Judges' Conference on Environmental Law, Environmental Law Institute, (1991).
Faculty member, New Jersey Judicial College (1992).
Course developer and faculty member "Basic Enforcement Skills," USEPA National Environmental Training Institute, (1992-1993).
Member, Nitrogen Technical Advisory Committee, New York City Department of Environmental Protection (1994 - ).
Member, Technical Review Committee for upgrading of Passaic Valley Sewerage Commissioners 330 mgd pure oxygen treatment plant, Newark, New Jersey (1995 - 2000)
Adjunct Professor, taught graduate course - Analysis of Receiving Waters, New Jersey Institute of Technology (1995 - 1997).
Member, Water Supply and Wastewater sub-committee, American Academy of Environmental Engineers, (1996- ).
Member, Plant Operation and Design Technical Advisory Committee for 100,000 gpd municipal package plant, Town of Saluda, North Carolina (1998 - 2002).
Reviewer, ***Reference Manual on Scientific Evidence***, Federal Judicial Center (2000).

## PUBLICATIONS


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2. Cardenas, R.R., Jr. and Bell, B.A., *Impact - An Environmental Case Study Involving a Lake and a Builder*, Proceedings, American Water Resources Association Conference, St. Louis, MO, 1972.

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10. Bell, B.A. and Zaferatos, T.E., *Evaluation of Alternate Solids Handling Methods for Advanced Waste Treatment Lime Sludges*, Journal of the Water Pollution Control Federation, 49, 146, 1977.

11. Bell, B.A. and Welday, J.M., *Comparison of Complete Mixed Activated Sludge and Unox Treatment of Brewery Wastes*, Water – 1977, G. Bennett, Ed. AIChE Symposium Series, 74, 29, 1978.

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14. Bell, B.A. and Welday, J.M., *Pure Oxygen and Air Activated Sludge Treatment of Brewery Wastes*, Proceedings, International Environmental Colloquium, University of Liege, Liege, Belgium, 1978.

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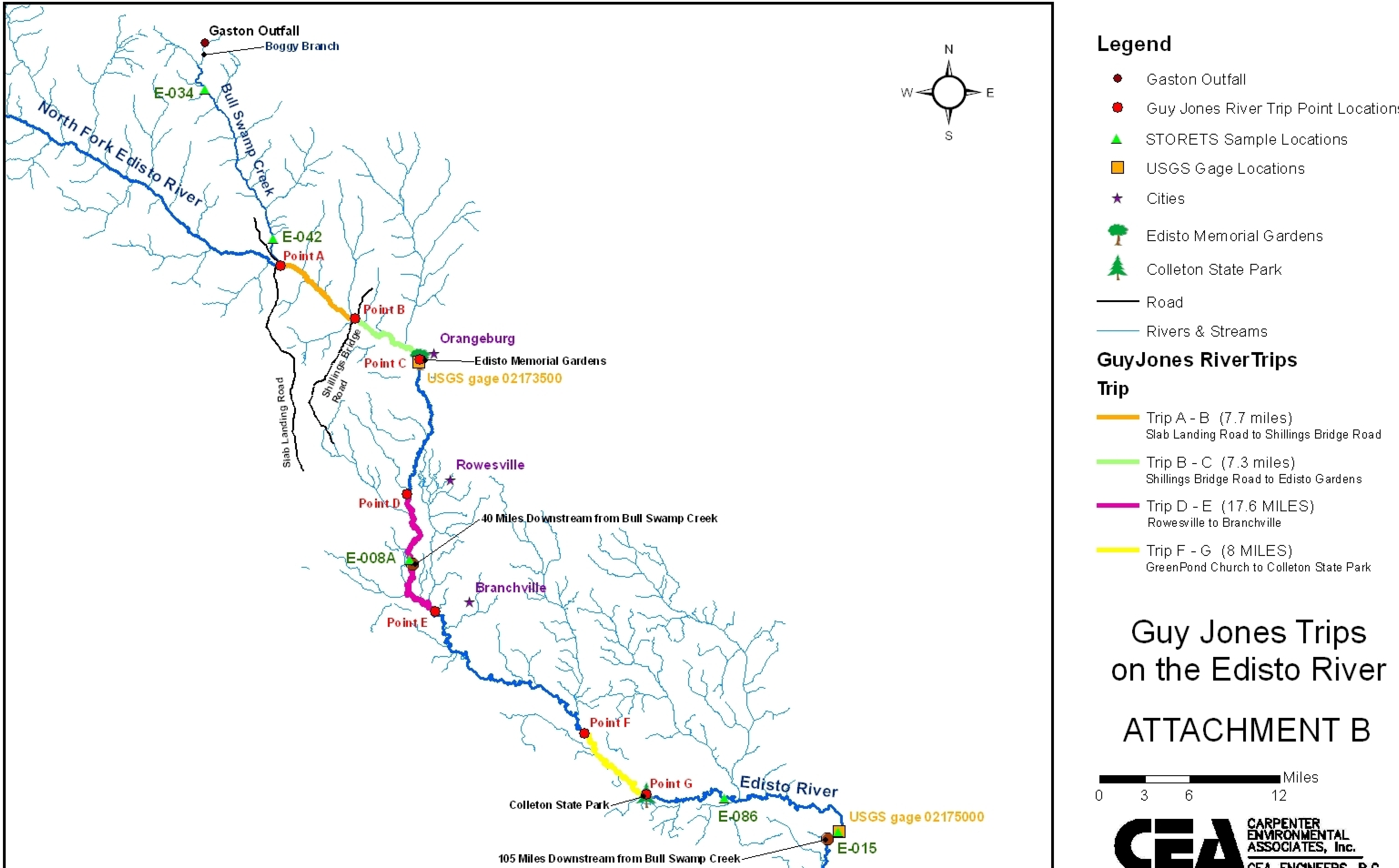


# Guy Jones Trips on the Edisto River

# ATTACHMENT B

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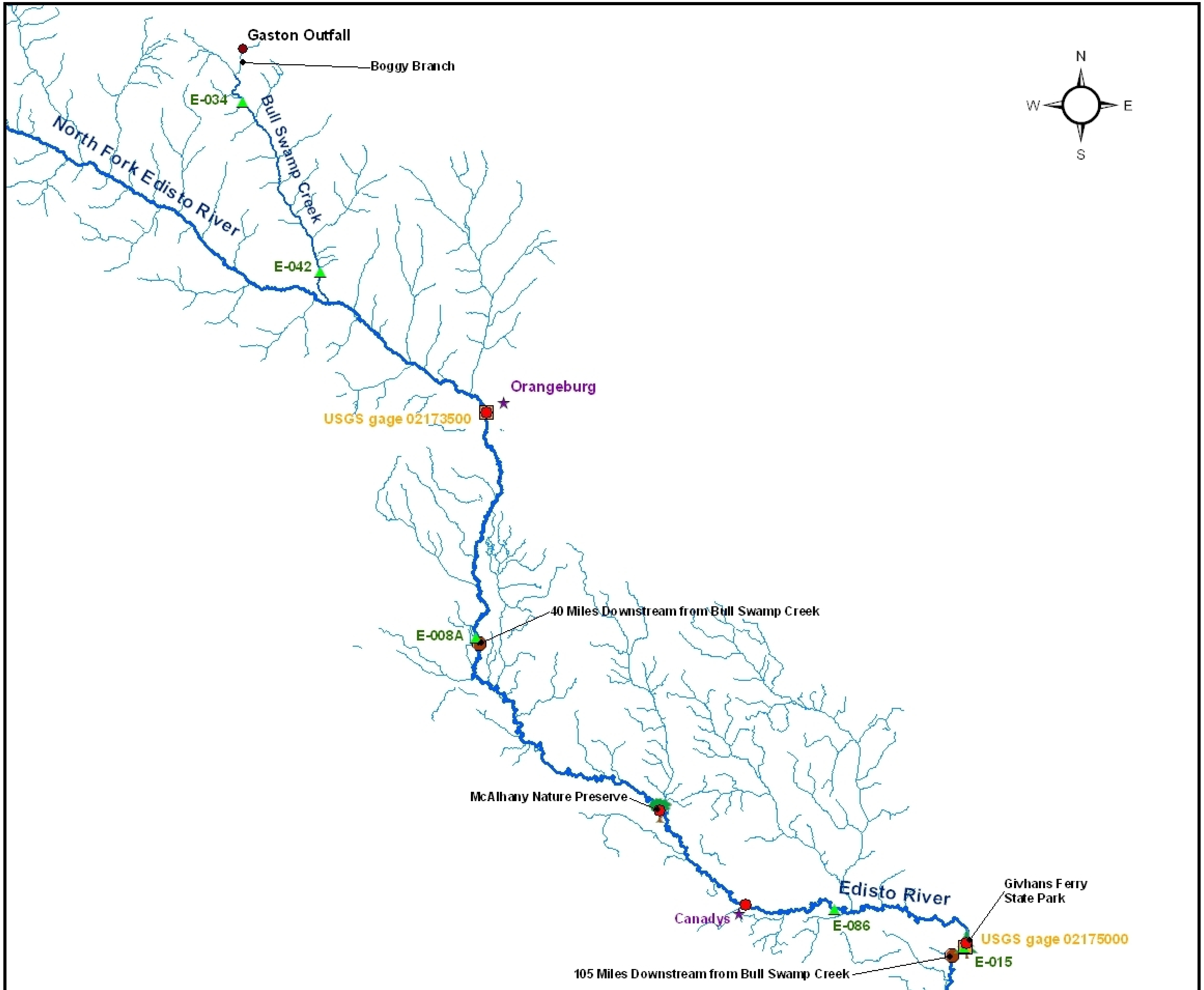


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**Legend**

- Gaston Outfall
- William Anderson River Trip Point Locations
- STORETS Sample Locations
- USGS Gage Locations
- Cities
- McAlhany Nature Preserve
- Givhans Ferry State Park
- Rivers & Streams

# William Anderson Trips on the Edisto River

# ATTACHMENT C

Miles
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CARPENTER ENVIRONMENTAL ASSOCIATES, Inc.
CEA ENGINEERS, P.C.